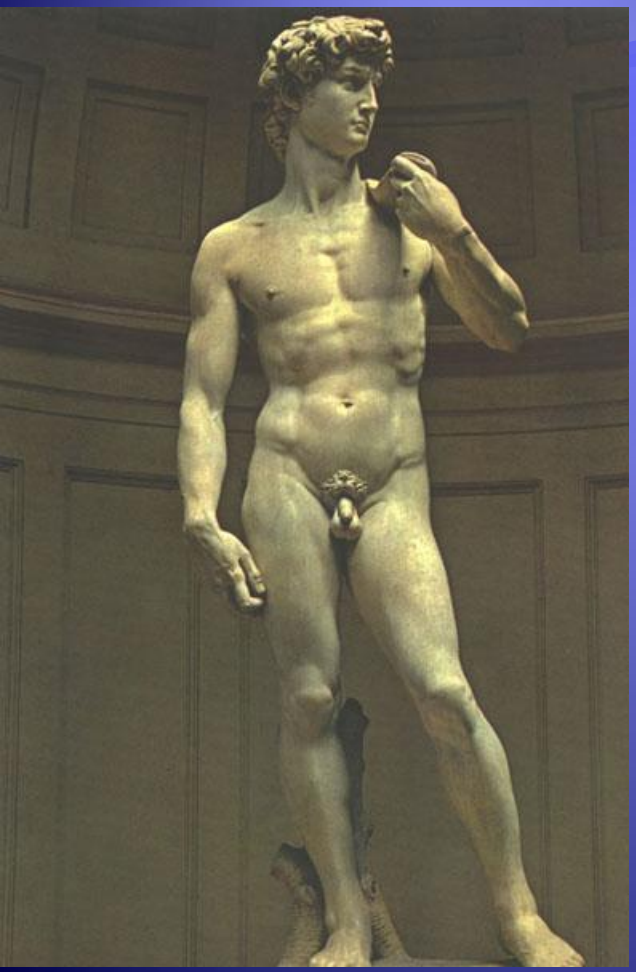
CH 24: REPRODUCTIVE SYSTEM, PART 1

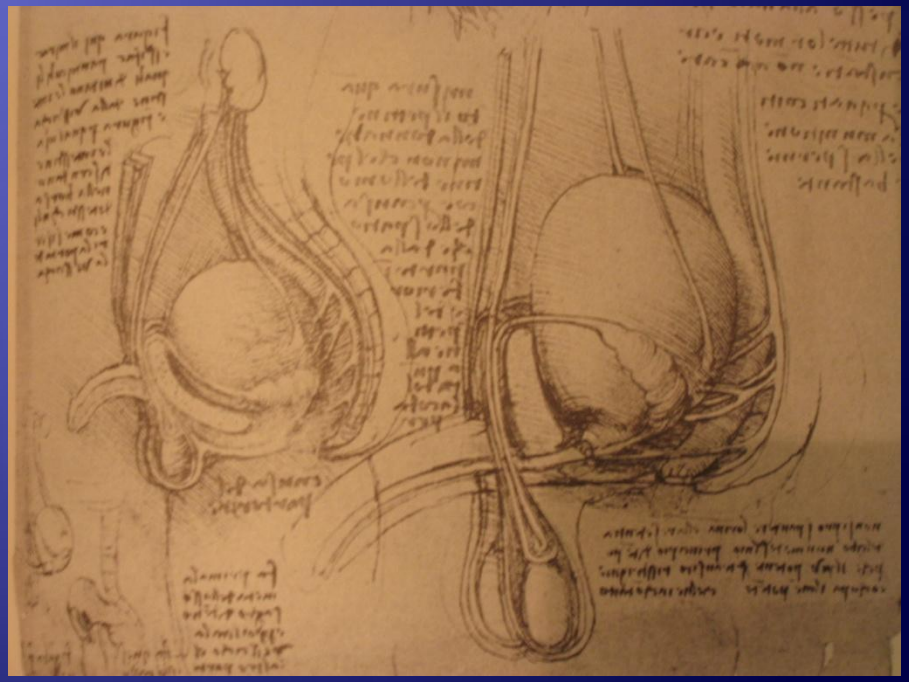


Goals:

1. Identify the structures of the male and female reproductive systems, including the gross and microscopic anatomy of the organs, structures and accessory glands and their basic functions.
2. Explain meiosis, spermatogenesis and oogenesis.
3. Discuss the changes that occur in the female reproductive system during pregnancy.

General Terminology:

- Gonads, or Primary Sex Organs = ovaries and testes
  - Produce gametes (ova and spermatozoa)
  - And hormones
- Transportation System
  - Transport of gametes
- Secondary or Accessory Organs
  - Glands (e.g., prostate)
  - External genitalia



Male Reproductive Anatomy

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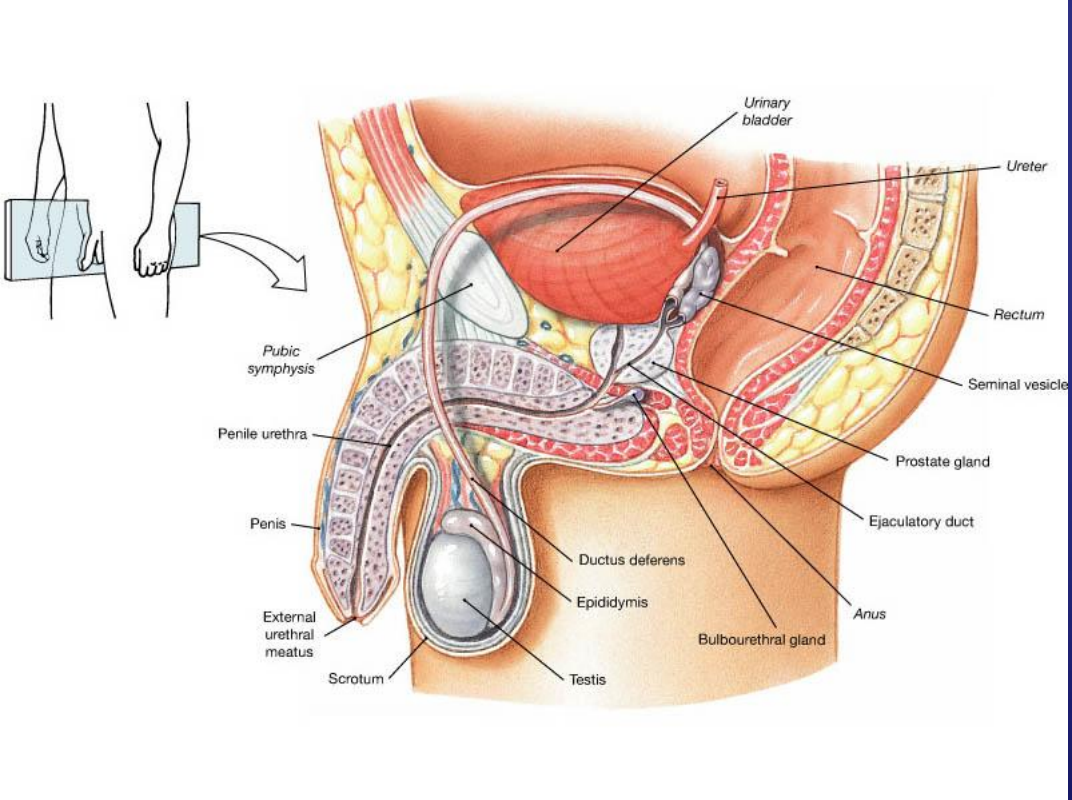
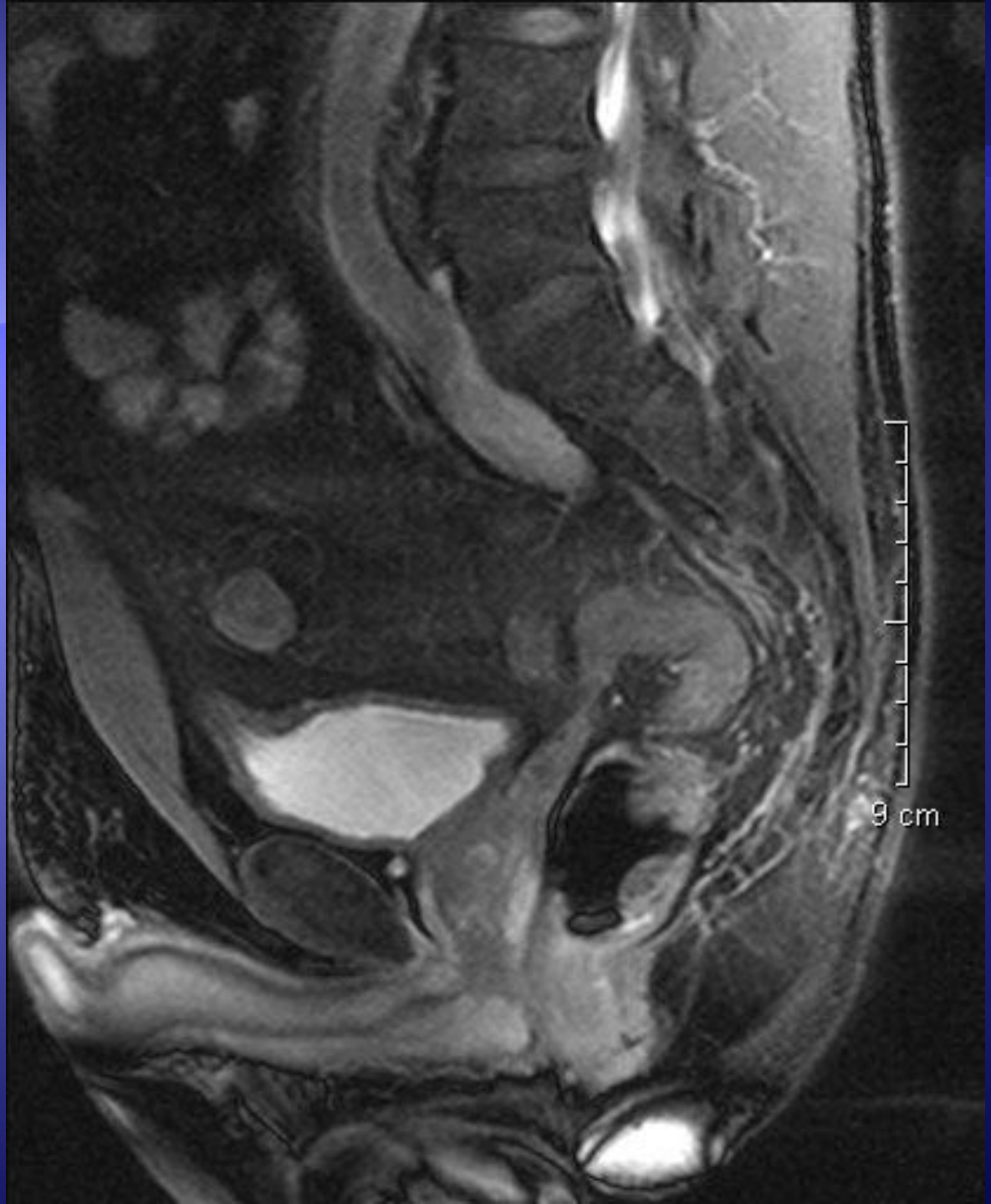
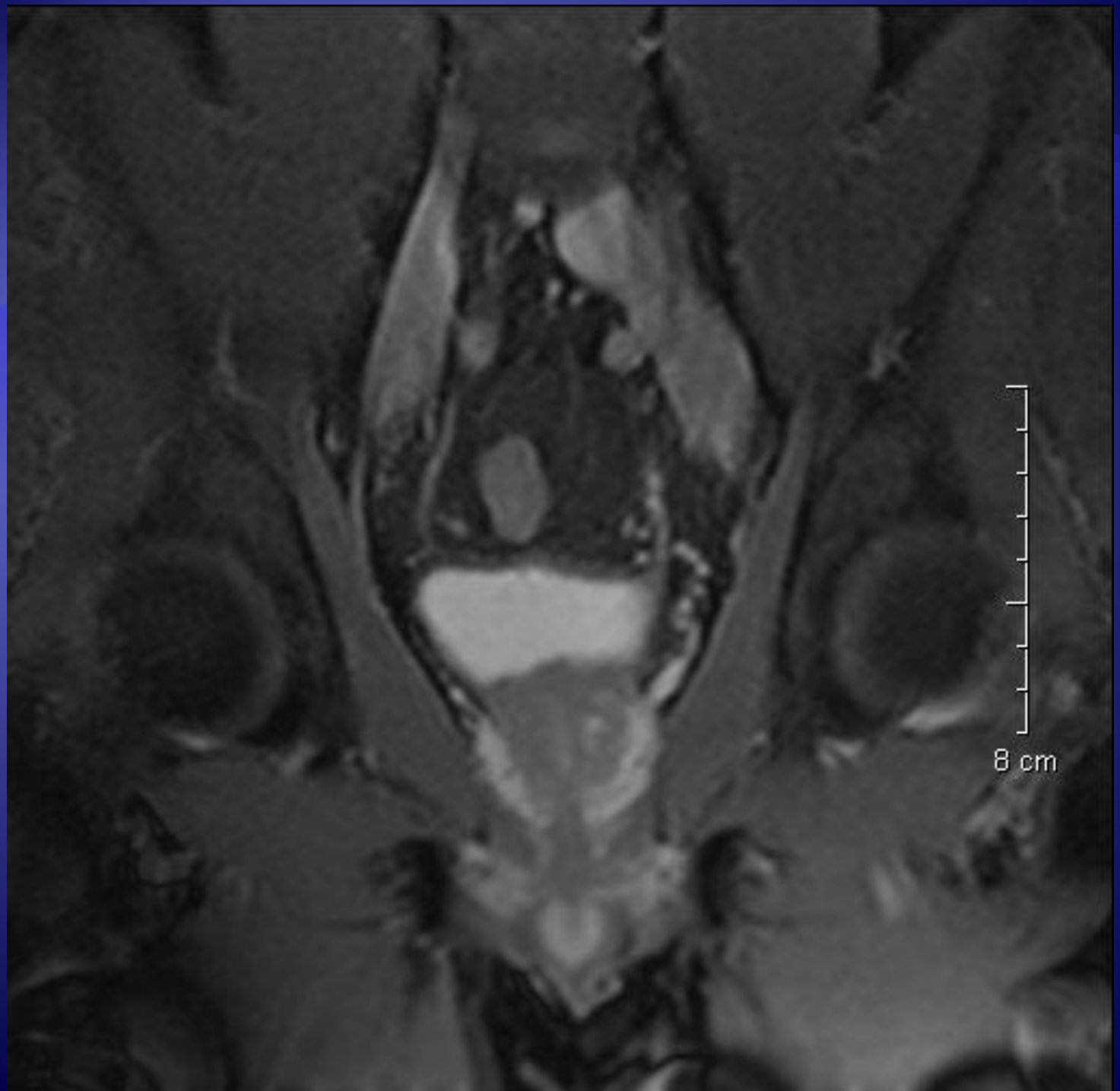
- Primary reproductive organs produce gametes
- Secondary reproductive organs:
  - Seminal fluid
  - Storage of spermatozoa
- Male reproductive and urinary tracts are partially shared

Overview of Male



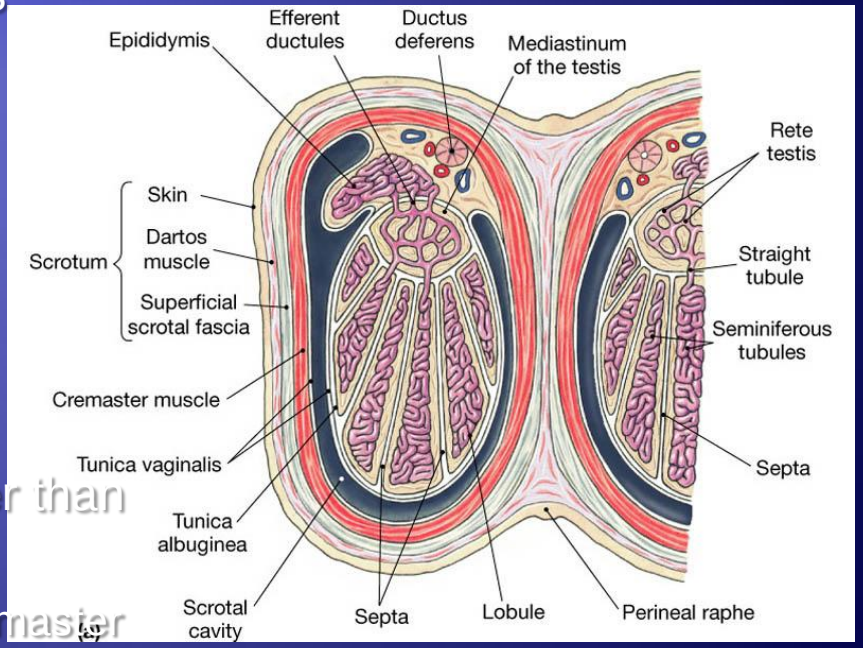

9 cm


8 cm

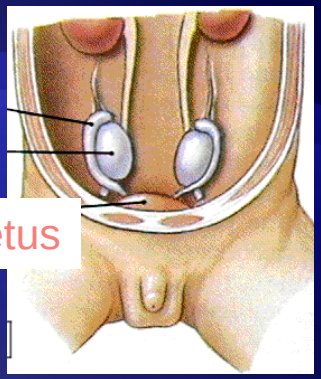
Scrotum: External Features

Function: supports, protects, and regulates temperature

- Scrotum consists of
  - Skin, fascia
  - Dartos muscle (smooth)
  - Tunica vaginalis
  - Median raphé
- Allows the testes to remain ~3°C cooler than core temperature
  - Involuntary contraction of dartos and cremaster muscles (cremasteric reflex) in response to cold or sexual arousal

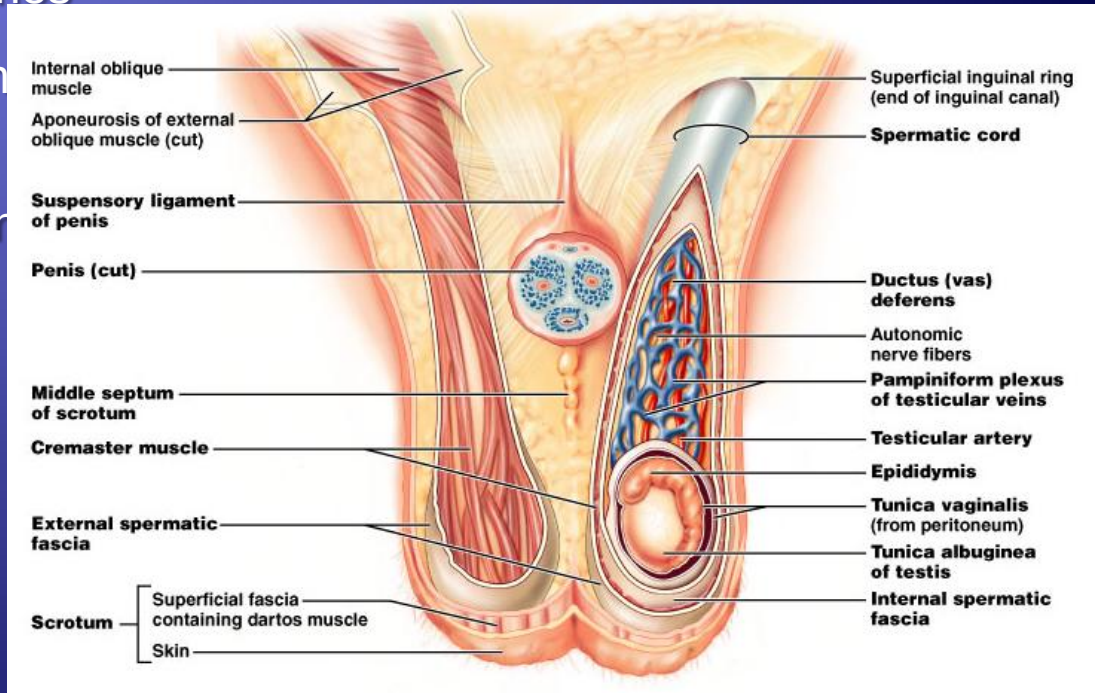


Testes (paired gonads)



4 month fetus

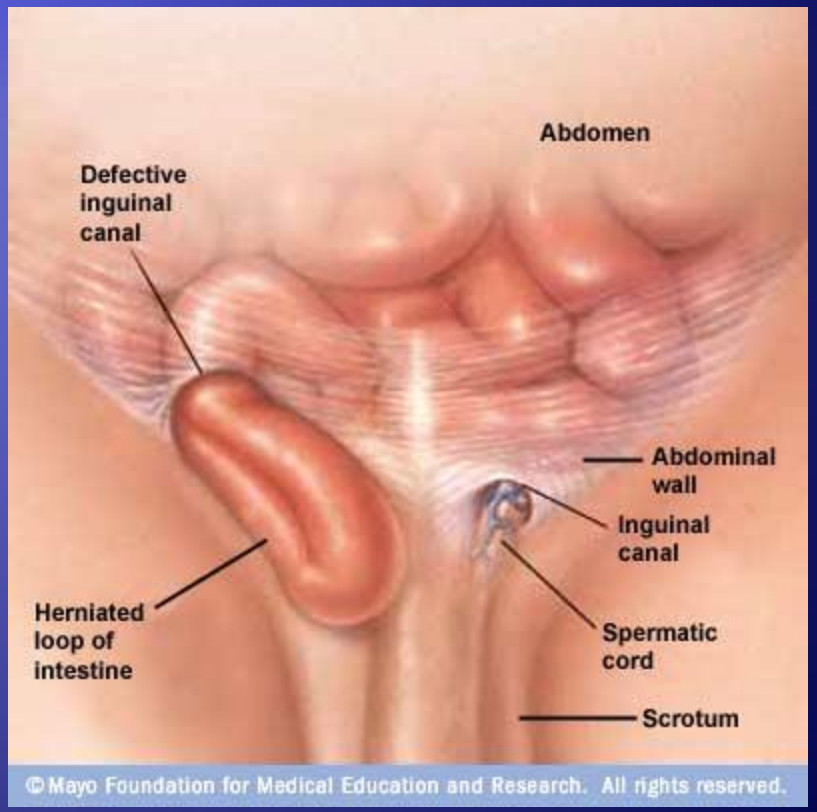
- Develop adjacent to kidneys
- Descend into scrotum through inguinal canal (function of gubernaculum testis) before birth
- Blood Supply via gonadal arteries
- Peritoneal lining is carried alon lining of scrotum
- Spermatic cord: bundle contain all the “duct work”



Inguinal Hernia

- Widening of inguinal canal
- Usually due to injury or heavy lifting
- Sometimes scrotal hernia
- Strangulation of intestine is possible

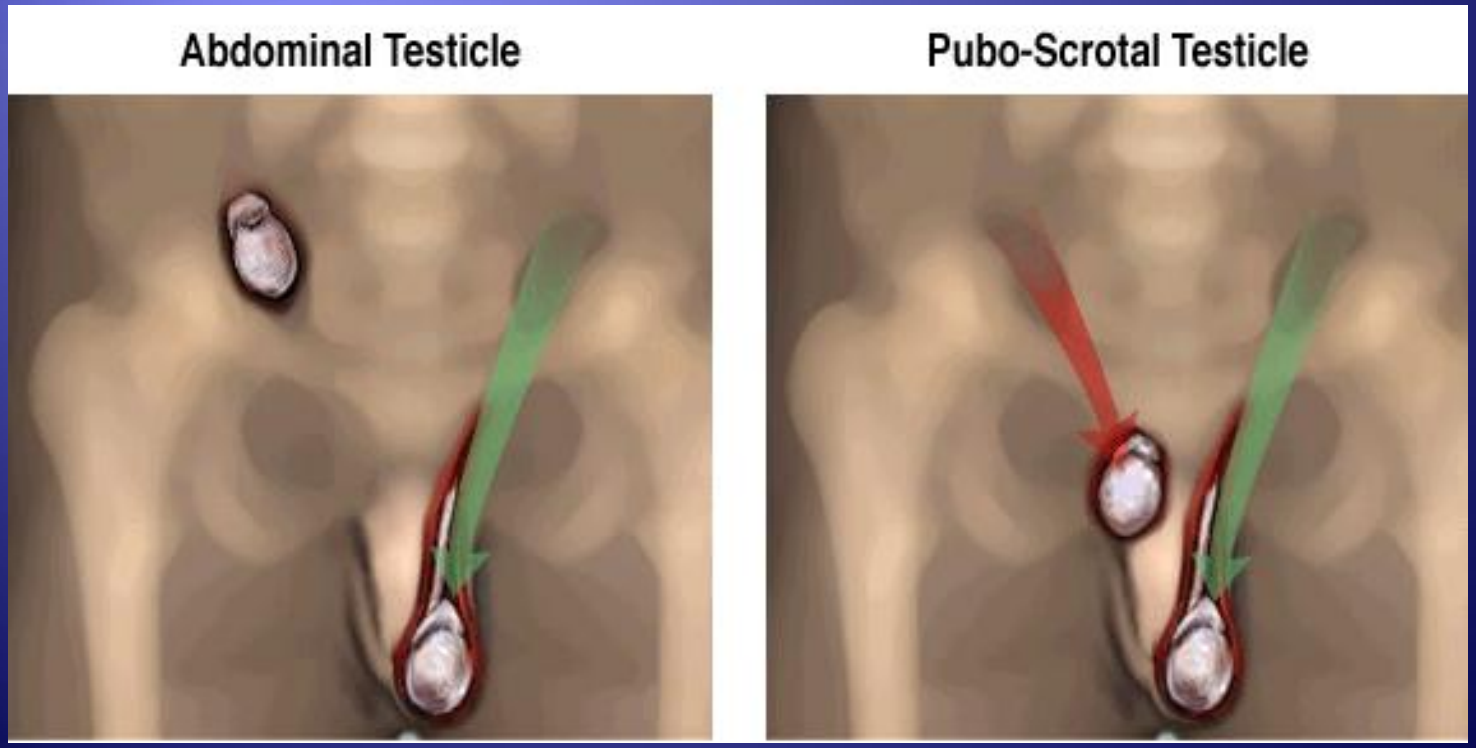
Hernia surgery



Cryptorchidism

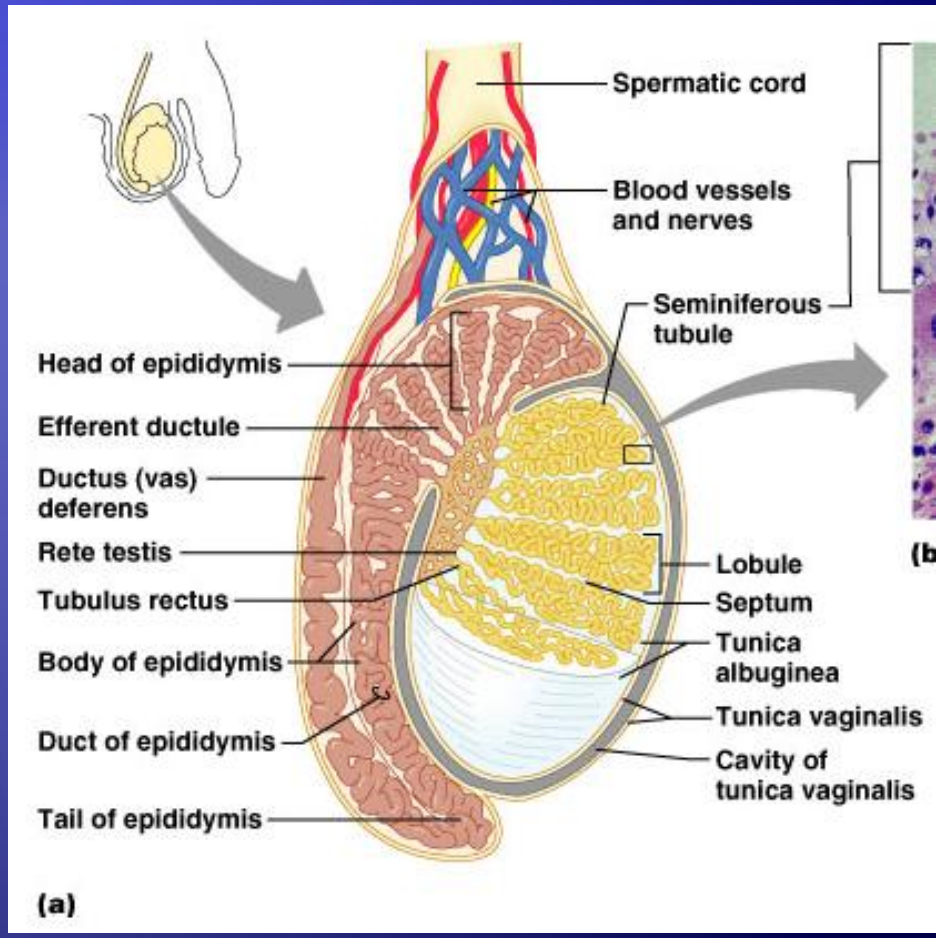
In 3% of full-term and 30% of premature deliveries

Significance? - Treatment?

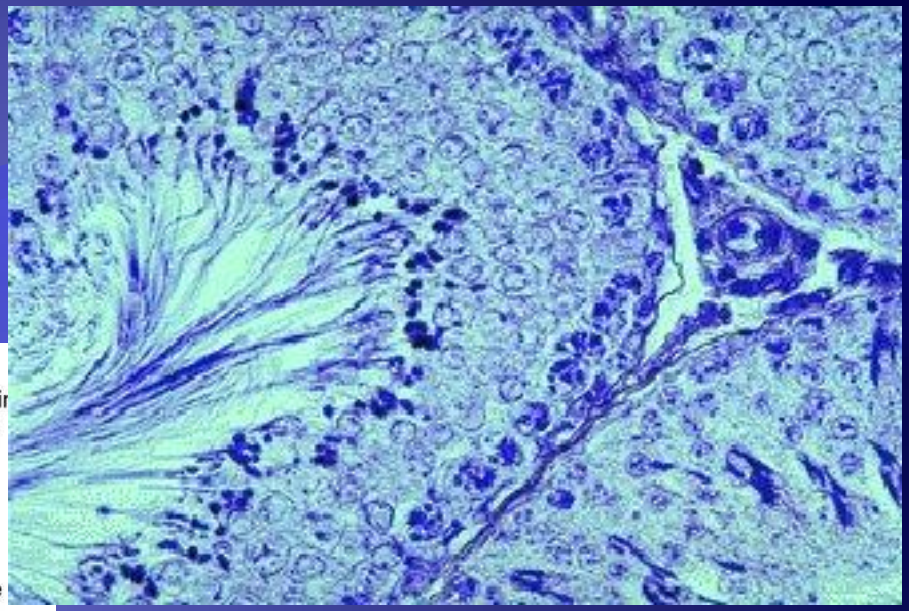


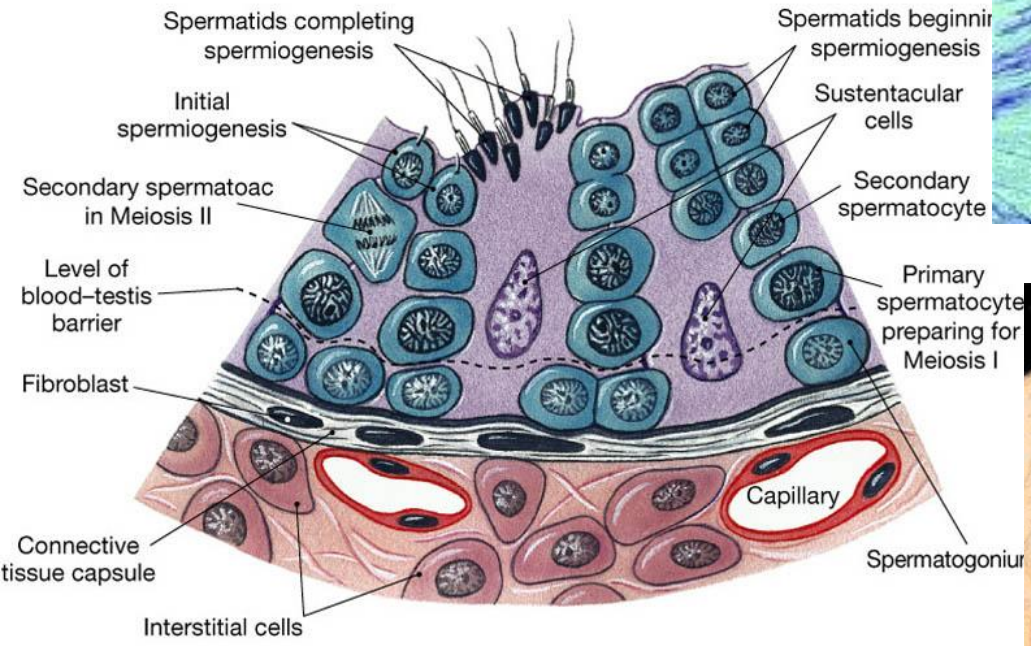
Internal Structure of Testes

- Fibrous capsule – tunica albuginea – surrounds testes
- Lobules contain approx. 800 Seminiferous Tubules collect at rete testis
- Interstitial (Leydig) Cells make testosterone
- Sustentacular (Sertoli) cells aid spermatogenesis

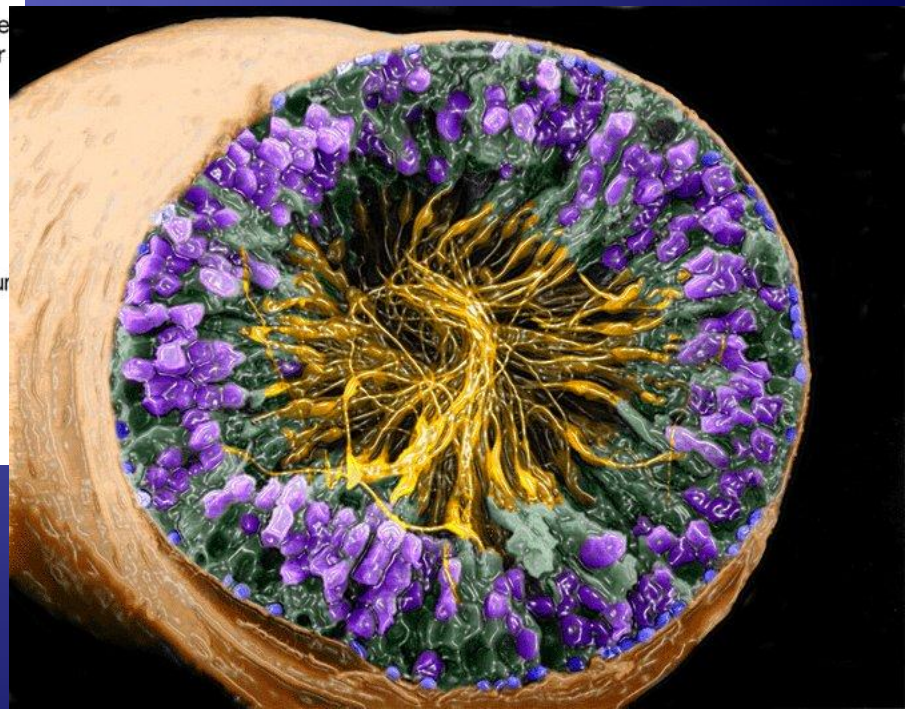


Seminiferous Tubules



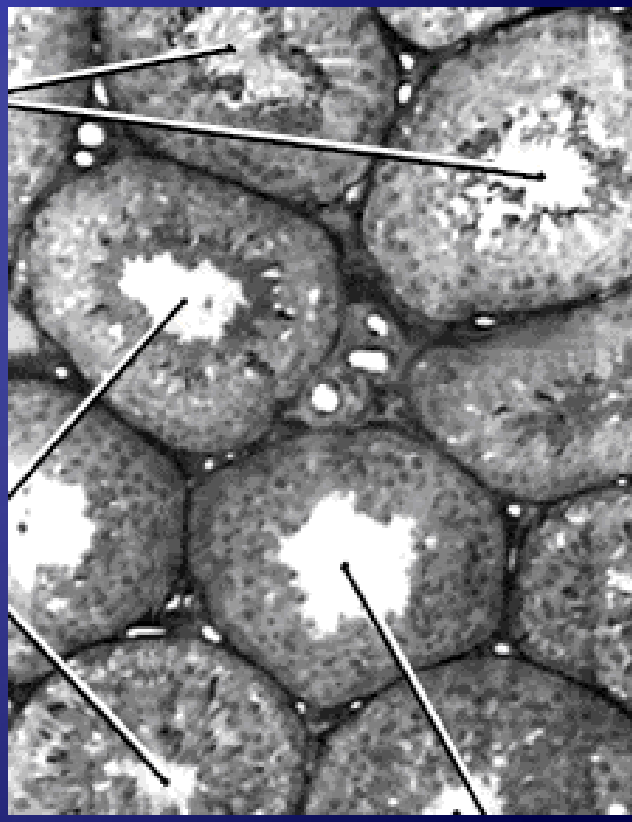


(d) Wall of seminiferous tubule



Spermatogenesis

- Spermatogonia divide (mitosis) and one of the daughter cells matures into a primary (1°) spermatocyte.
- Meiosis begins, two secondary (2°) spermatocytes. Another division produces spermatids.
  - Crossing over (not in book)
- Spermiogenesis: Spermatid maturation into spermatozoa with help of sustentacular (Sertoli) cells
- Spermiation: Spermatozoon released into lumen of seminiferous tubules



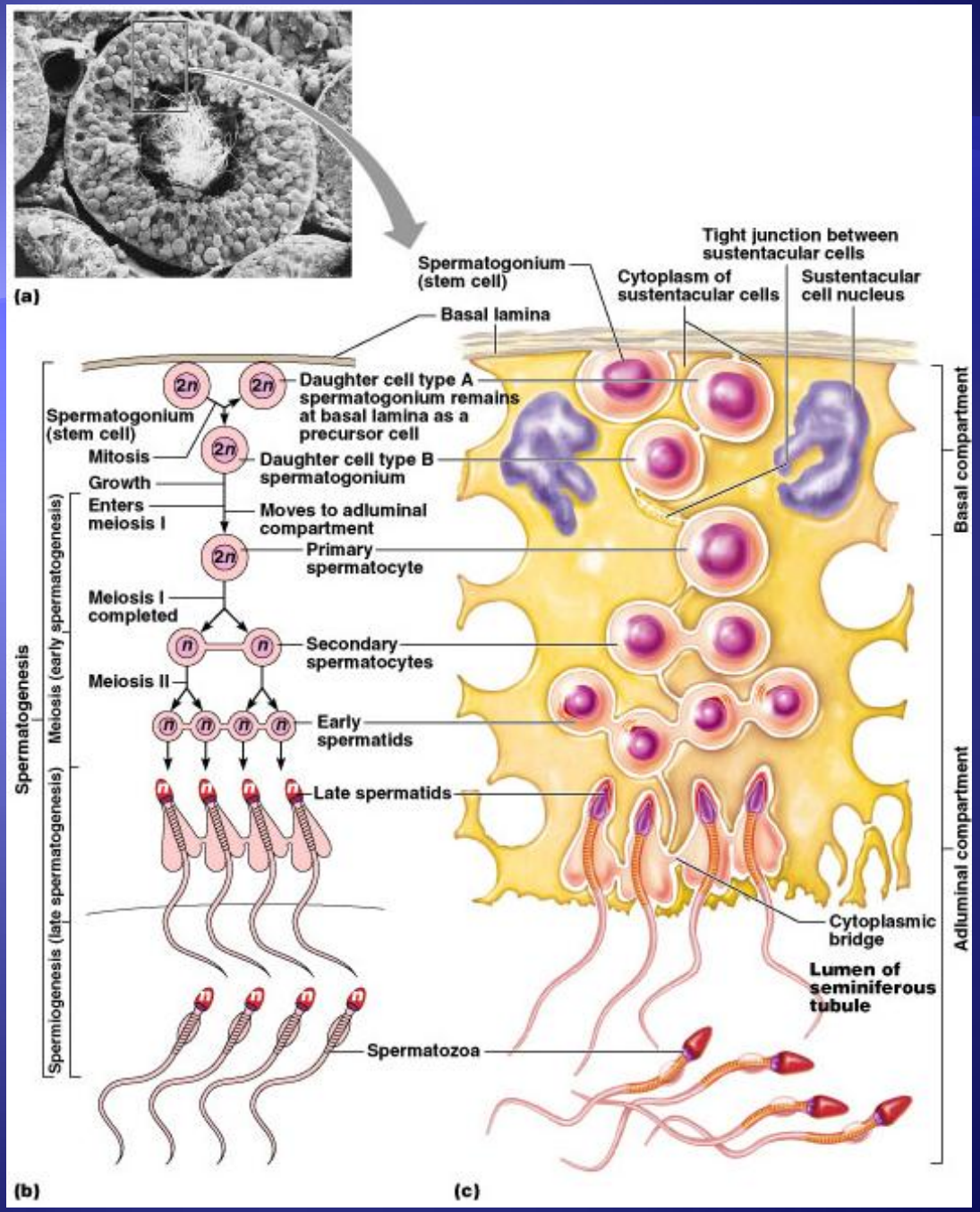
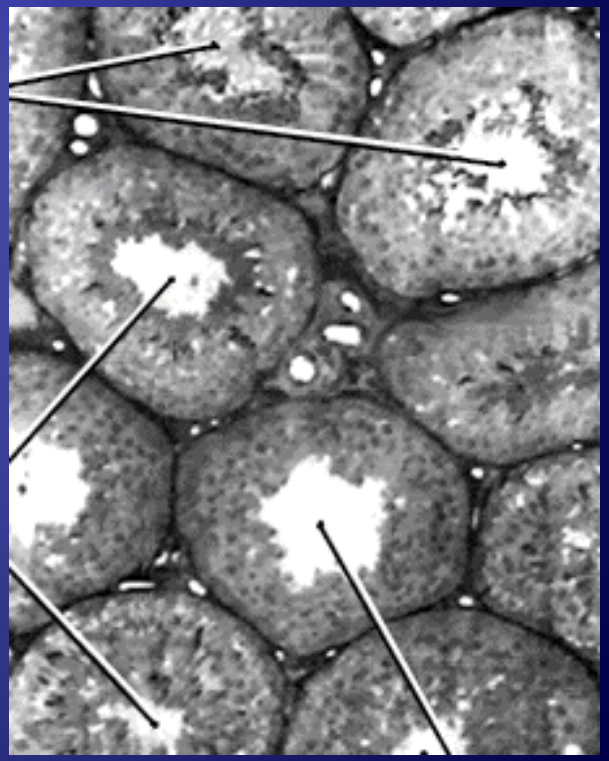

(a)
Tight junction between sustentacular cells
Spermatogonium (stem cell)
Cytoplasm of sustentacular cells
Sustentacular cell nucleus
Basal lamina
Daughter cell type A spermatogonium remains at basal lamina as a precursor cell
Spermatogonium (stem cell)
Mitosis
Daughter cell type B spermatogonium
Growth
Enters meiosis I
Moves to adluminal compartment
Primary spermatocyte
Meiosis I completed
Secondary spermatocytes
Meiosis II
Early spermatids
Late spermatids
Spermatogenesis
Meiosis (early spermatogenesis)
Spermiogenesis (late spermatogenesis)
Basal compartment
Adluminal compartment
Cytoplasmic bridge
Lumen of seminiferous tubule
Spermatozoa
(b)
(c)

Fig 24.4

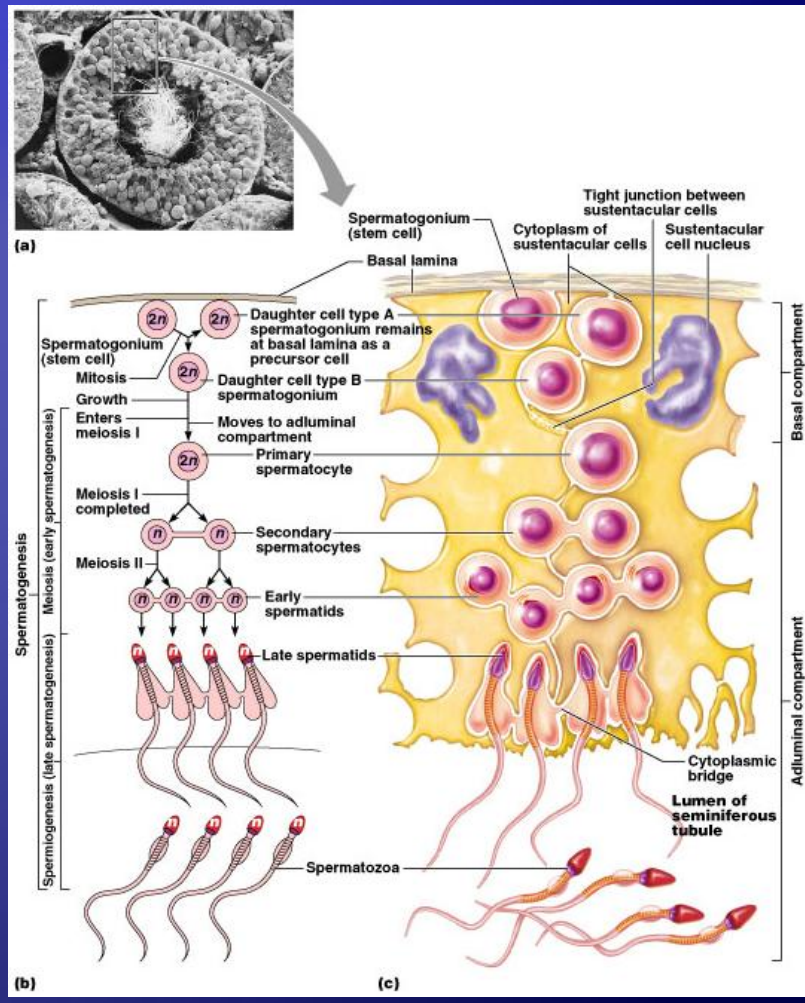
Spermiogenesis

- Spermatid maturation into spermatozoa with help of sustentacular (Sertoli) cells
- Spermiation: Spermatozoon released into lumen of seminiferous tubules



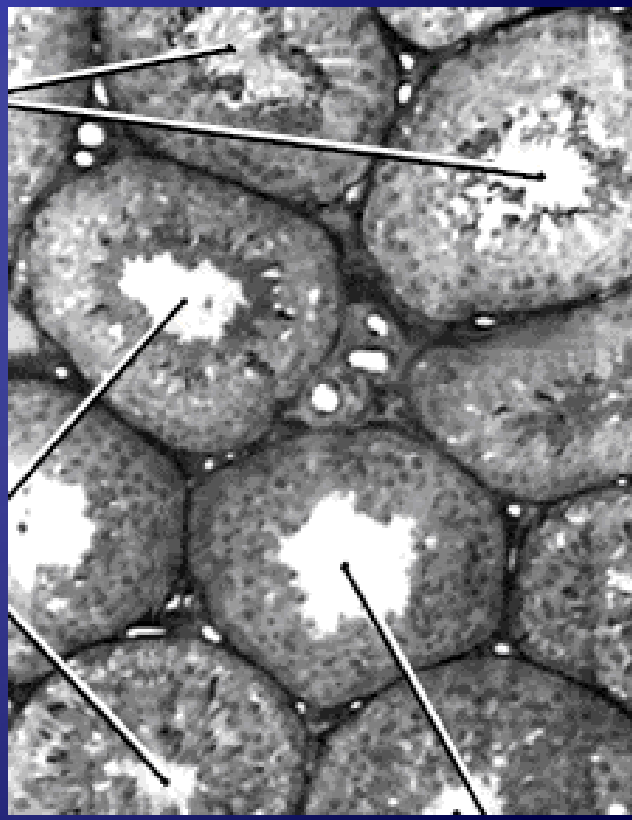
Sustentacular (Sertoli) Cells

- **Sertoli Cells:**
  - **Maintenance of blood testis barrier**
    - special lumen fluid high in sex hormones, K^+ and aa
    - Protection from immune attack (due to sperm specific Ag)
  - **Suspend spermatids and support spermatogenesis and spermiogenesis**
    - FSH and Testosterone work via Sertoli cells
    - Secretion of inhibin to slow sperm production
    - Secretion of androgen-binding protein (ABP)



Interstitial (Leydig) Cells

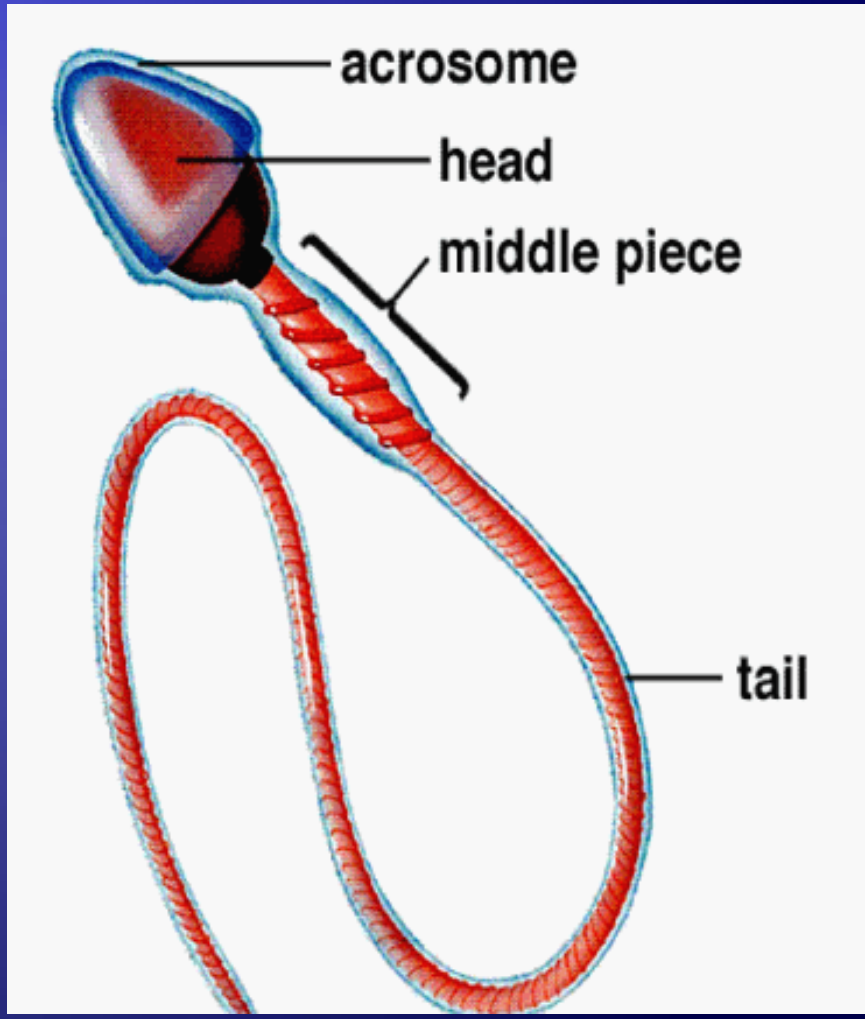
- Interstitial Cells
  - Located between tubules produce testosterone
    - Controlled by LH



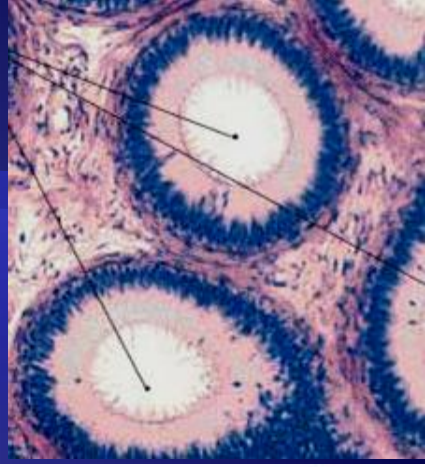
Anatomy of a Spermatozoon

Mature sperm has 3 portions:

1. Head with acrosome (containing enzymes) and compressed nucleus
    1. Acrosomal Reaction
2. Middle piece with lots of mitochondria. Why?
3. Tail - flagellum - (rotating in corkscrew fashion)



Epididymis



~ 7 m long, single tube

Head - superior, receives spermatozoa

Body - distal and inferior

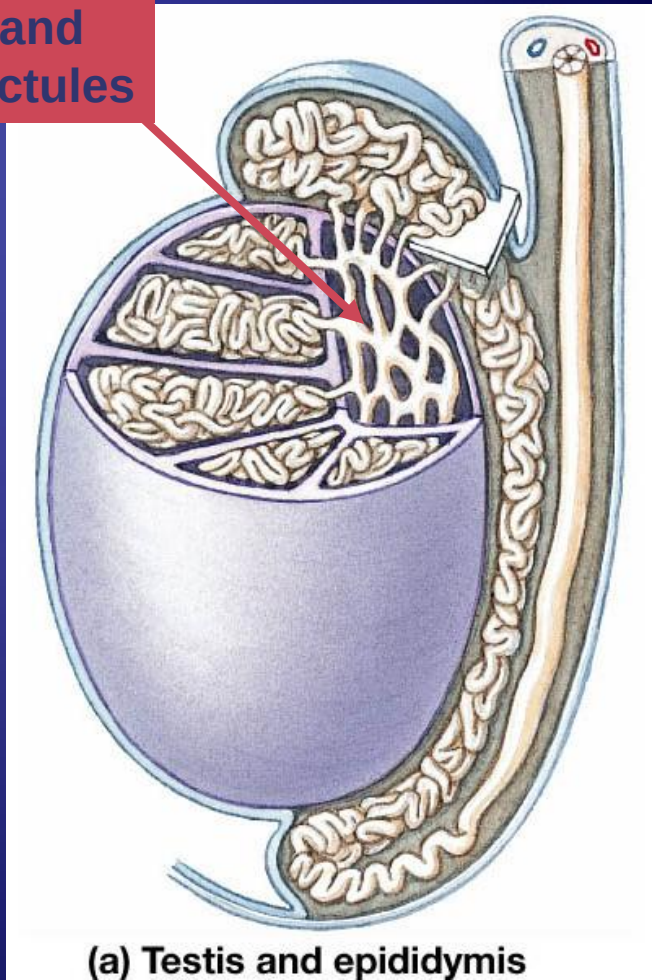
Tail - leads to ductus deferens

Functions:

1) Monitors and adjusts tubular fluid (lining has stereocilia!)

2) Recycles damaged spermatozoa

3) Stores sperm and facilitates maturation (capacitation)



(a) Testis and epididymis

Spermatic Cord

Can be palpated as it passes over the pubic brim.

Constituents :

- Pampiniform plexus of spermatic vein
- Spermatic artery
- Ductus (vas) deferens
- Smooth muscle
- Lymphatics
- Nerves-ilioinguinal and genitofemoral

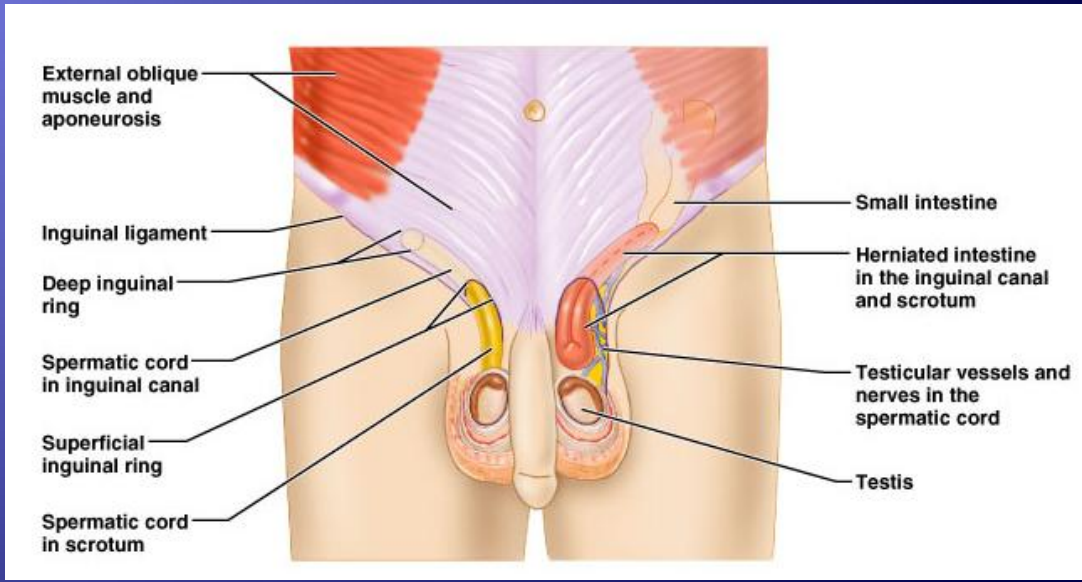
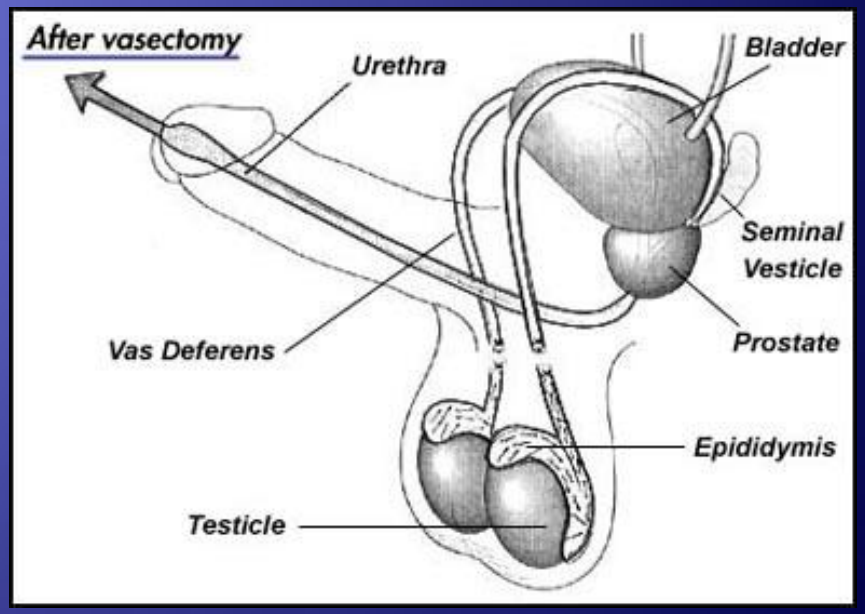

External oblique muscle and aponeurosis
Inguinal ligament
Deep inguinal ring
Spermatic cord in inguinal canal
Superficial inguinal ring
Spermatic cord in scrotum
Small intestine
Herniated intestine in the inguinal canal and scrotum
Testicular vessels and nerves in the spermatic cord
Testis

Fig 24.7

Vasectomy

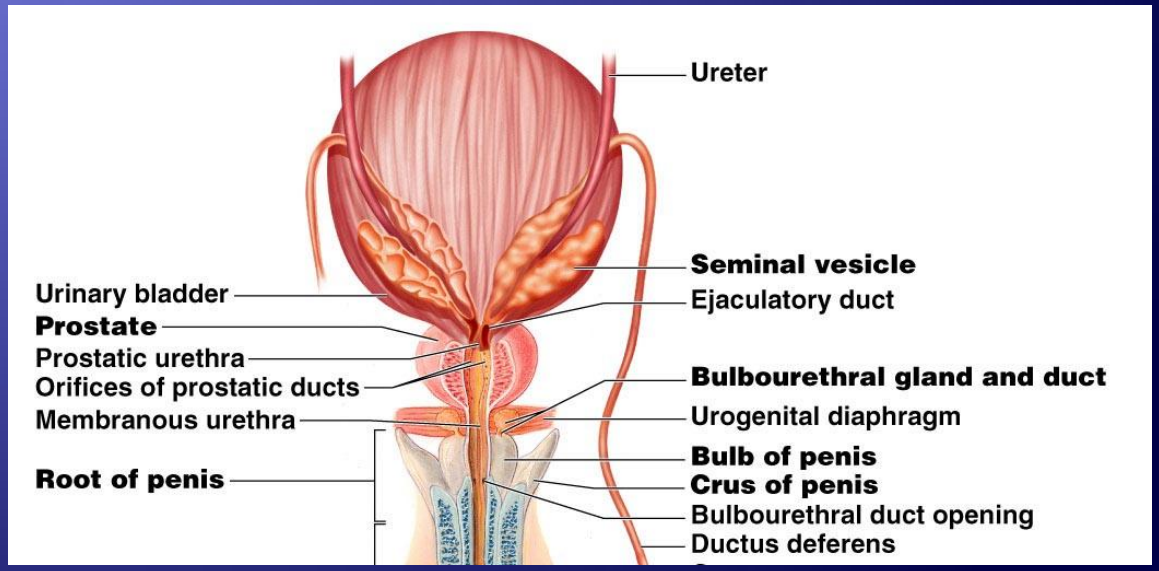
- Local anesthetic
- Two small incisions
- Ligate and remove a small section of each vas deferens
- Seminal fluid is unchanged
- Spermatozoa are reabsorbed
- Reversal?



Accessory Glands

Provide for 95% of the seminal fluid

1. Seminal Vesicles
2. Prostate Gland
3. Bulbourethral glands



1. Seminal vesicles

- Paired, on back wall of urinary bladder
- Tubular (~ 15 cm), blind end
- Produce 60% of semen, hormones, fructose, etc.
- Activate sperm (leading to motility)

2) Prostate Gland

20 - 30% of seminal fluid

Single, doughnut-shaped

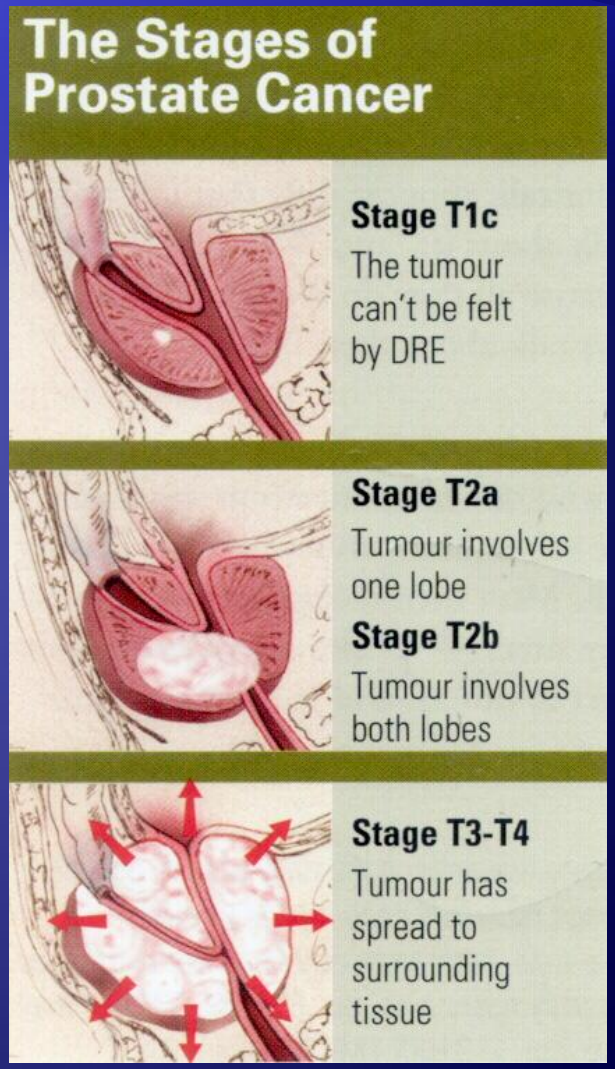
Prostatic urethra

Secretion contains:

- Citrate
- Seminal plasmin (mild antibiotic)

Prostate Cancer

- Risk Factors:
  - Age
  - Race
  - Genetics
- Usually grows slowly
- Often slow urination is first sign
- Digital Rectal Exam (DRE) and/or PSA
  - Imaging techniques
- Treatment depends on size of tumor and other factors

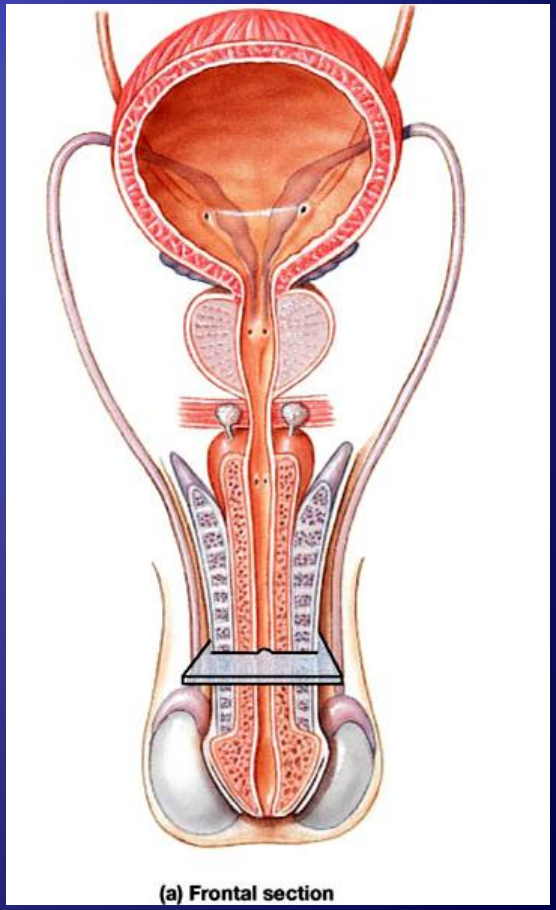


3) Bulbourethral glands (Cowper's glands)

Pea size, paired, at base of penis

Produce about 10% of semen

Alkaline mucus buffers the acid that may be present in urine



Semen

2-5 ml ejaculate

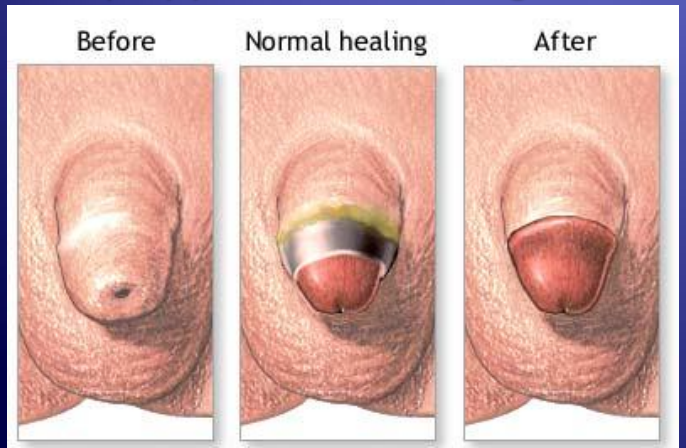
Ejaculation of semen by pelvic floor and penile muscles (Sympathetic division induces peristalsis in tract)

Constituents:

1. sperm - 20 - 100 million sperm/ ml
2. seminal fluid – 60% from seminal vesicles
3. enzymes - proteases and seminal plasmin

Penis

- Root - fixed to ischial rami
- Shaft
- Glans – enlargement of corpus spongiosum
  - Prepuce = foreskin – partially covers glans and surrounds external urethral meatus (removed in circumcision)
  - Preputial glands - produce smegma (supports bacterial growth, such as *E. coli*)



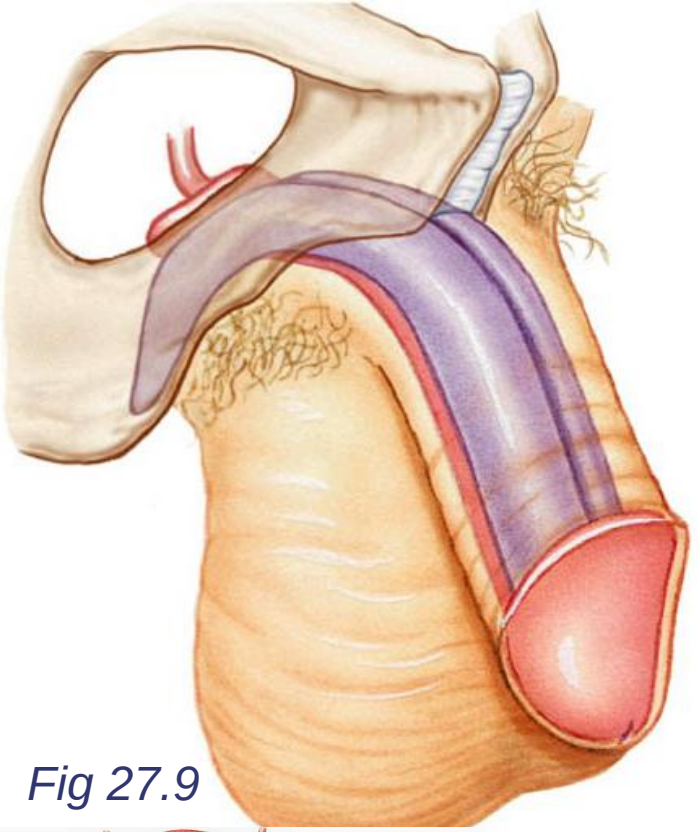
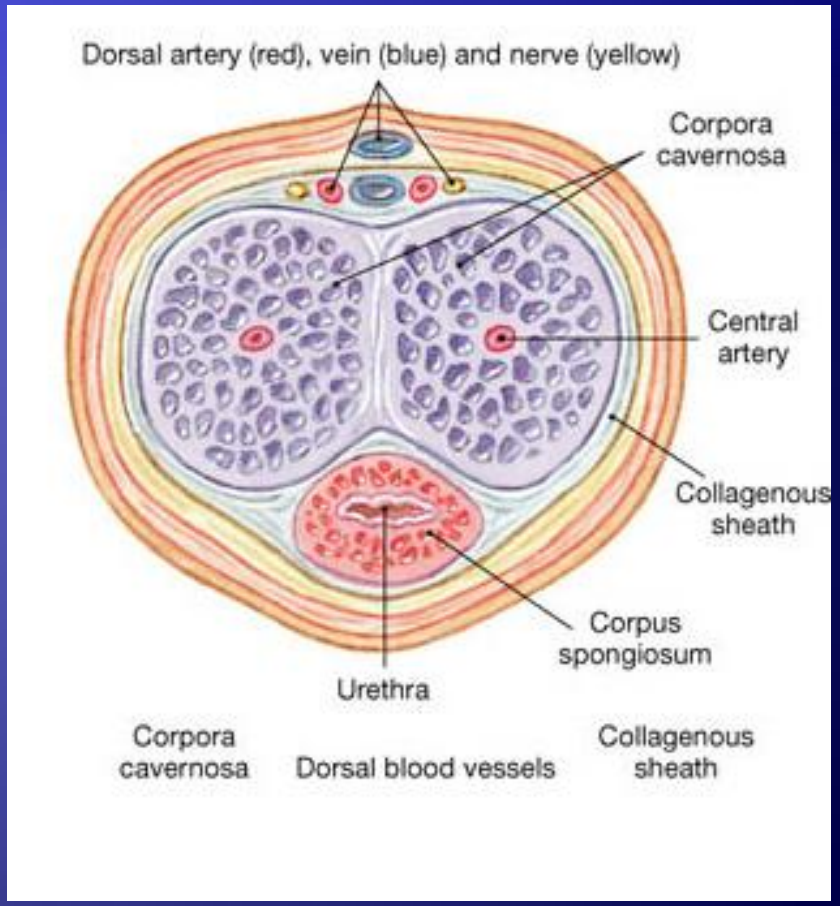


Fig 27.9

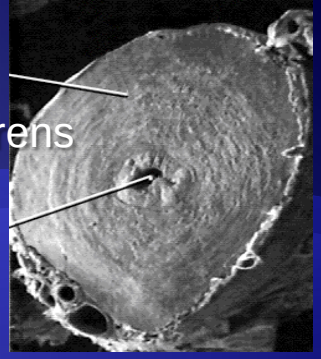
Penis

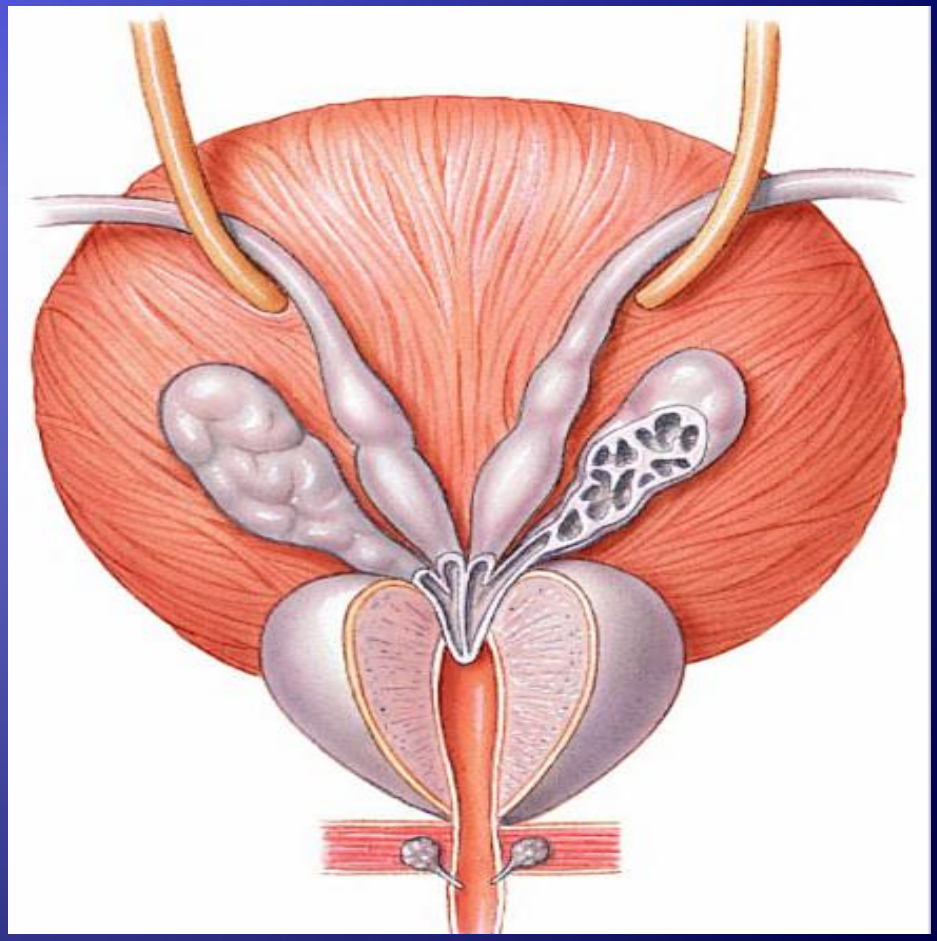
- **Shaft** with erectile tissue
  - Corpus Cavernosum (2)
  - Corpus Spongiosum
- Dorsal Artery and Vein
- Penile Urethra



Pathway of Semen

- Seminiferous tubules
  - Convoluted, then Straight
- Rete testis
- Efferent Ductules
- Epididymis (head, body, tail)
- Vas (ductus) deferens
- Ampulla of vas deferens
- Ejaculatory duct
- Prostatic urethra
- Membranous urethra
- Penile (spongy) urethra





Posterior view

Fig 27.8